Blueprint for Waste Management in Ontario

Appendix 2

Waste Reduction, Reuse, Recycling and Recovery Report

Ontario

Ministry of the Environment

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This is one of 11 appendices to the Blueprint for Waste Management. A complete list is presented on the inside of the back cover.

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APPENDIX 2
WASTE REDUCTION, REUSE, RECYCLING AND RECOVERY REPORT

This Appendix expands on the Blueprint in reviewing past and current efforts and proposing steps that may be taken to maintain Ontario's leadership position in waste reduction, reuse, recycling and recovery (4 Rs). Efforts in these areas have been increasing in Ontario and many other jurisdictions over the past ten years. Particular attention is paid to the roles of the public, industry and government in generating an intensified 4R program. A comprehensive overview of the problems, the objectives and possible strategies are highlighted to stimulate discussion and lead to the formulation of action plans receiving widely based support.

This paper contains recycled fibre.

APPENDIX 2

WASTE REDUCTION, REUSE, RECYCLING AND RECOVERY REPORT

INTRODUCTION

Waste reduction, reuse, recycling and recovery (of material and energy) have been practised by individuals and industries; these activities have gained a great deal of prominence as an element of waste management over the past decade. This growing interest has developed from our increased awareness of problems resulting from some of our waste disposal practices and the difficulty experienced in the establishment and operation of landfill sites.

Many projects have been undertaken to evaluate and demonstrate new technologies, notably those built into large material processing and recovery plants. Many of these plants failed to meet the expectations of their proponents but others proved successful and are now in routine operation. In some cases, mass incineration technology as used in Europe and Japan to burn waste without processing was chosen because of lower technological risk. The current trend is towards mass incineration, although material processing plants, which are normally less capital intensive, are also being established. Low technology projects, such as source separation, have been increasing in number, although such projects do not have the same potential as the high technology plants to handle the bulk of the waste stream. The success of both low and high technology projects depends upon identified markets.

The Ministry of the Environment has also followed a similar course in its own programs. Waste processing for material and energy recovery was pursued through the Resource Recovery Program. Technology evaluation and development, as well as market development efforts for recovered materials have been undertaken and continue at the Ministry's Experimental Plant for Resource Recovery in Downsview. The Source Separation Program was implemented to encourage development of low technology systems. The Ministry of the Environment supports the Energy from Waste Program of the Ministry of Energy and both Ministries work closely to co-ordinate their efforts. All of these programs, as well as numerous other studies and

demonstrations, promote projects to recover the resource values in waste and to reduce the quantity of waste requiring landfill.

The Ministry of the Environment also provides support to municipalities for waste management planning. Waste Site Improvement Program funding is also provided to improve waste disposal operations at landfills.

In preparing an Ontario waste management program for the future, past successes and failures and current situations will be reviewed, and new policies, programs and research directed toward waste reduction, reuse, recycling and recovery will be considered.

The following presents a review of our experience to date and offers some suggestions for possible future directions. We expect that this review will stimulate more ideas and recommendations to assist in formulating the Blueprint for Waste Management.

WASTE REDUCTION

Waste may be considered as material for which no further value is recognized by the individual or a company producing it. Waste material may in fact have a use, but realizing that use requires effort and involves cost. Without the knowledge or desire to use the material, it becomes waste. For example, much of the food and yard wastes, which represent from 25 to 40% of municipal solid waste, could be composted by homeowners. The large proportion of such materials in the waste stream indicates that a majority of residents prefer to put them out as waste for collection and disposal at costs typically ranging from $20 to $60 a tonne, or approximately $10 to $25 per capita per year.

Our buying habits as consumers contribute to the waste stream when we select products that have a significant percentage of ultimately discarded packaging materials. A refillable or recyclable container can be used to replace a throwaway container and effect a reduction in waste.

Increasing the durability or repairability of a product to lengthen its useful life can also reduce the amount of waste. The higher initial cost of such a product must be weighed against the potential increase in product life.

Consumers expect that a premium product will provide superior life and service.

Waste reduction can be related to the design of goods or packaging to ensure that materials can be recovered or recycled. For example, laminated packaging, non-soluble glues on cartons and bi-metallic cans provide obstacles to recycling in comparison to items designed to facilitate recycling.

WASTE REUSE

The direct reuse of materials, which would otherwise become waste, provides a means of reducing the quantity of waste destined for landfill. Well known examples include the use of refillable glass bottles for soft drinks and beer. In many cases, corrugated cardboard containers are reused for shipping materials.

Refillable glass containers designed for a specific product, such as beer, provide the opportunity for recycling of the material when the reusable container has served its useful life. The glass is melted down to emerge as a new refillable bottle.

Other materials, such as corrugated cardboard, offer a similar opportunity for recycling and reuse of the material in its original form.

WASTE RECYCLING

Waste recycling can be defined as the use of a waste material as a replacement for all or part of a virgin material in a manufacturing process. The waste material is used because of its value. From an environmental perspective, waste recycling results in resource conservation.

Recycling is perceived by many as the recovery of material which is then used to make more of the original product, e.g. glass containers recycled to glass cullet used to produce more glass containers. A broader range of recycling activities is possible. Paper in waste can be recycled for its fibre value to produce more paper, as an insulation material, or for its fuel value. Glass may be used as cullet or as one of the raw materials for other uses, e.g. as an addition to asphalt for road surfacing.

The quality requirements of recycling for specific material recovery are generally more stringent than for conversion processes, e.g. the recycled product quality of glass for container use is more stringent than for use as an aggregate.

Source Separation

Source separation may be defined as the process of keeping recyclable materials separate from mixed waste for the purpose of obtaining industrial raw materials.

This process has been used by business and industry for many years through a system of dealers and brokers involved in obtaining, processing and marketing secondary materials such as scrap metal, paper and old corrugated cardboard containers.

The direct trading of waste materials between industries, such as arranged through the Canadian Waste Materials Exchange managed by the Ontario Research Foundation, is another form of source separation.

Another type of source separation, and the one most often identified with this form of recycling, appears in projects which involve the public directly in sorting domestic or office waste for eventual recycling. The most common activity is the collection of old newspapers directly from households. Other systems require the public to deliver recyclable materials to depots. Glass and cans are two of the other principal materials involved. These projects are operated by municipalities, private companies, environmental groups, charitable organizations or community service clubs. For materials, such as glass which have very stringent product quality requirements, source separation provides the best means of achieving the quality requirements.

RESOURCE RECOVERY

Resource recovery may be defined as the processing of waste for material or energy recovery.

These processes include the conversion of municipal solid waste to a usable product such as refuse derived fuel or compost, and incineration of

unprocessed waste to produce energy which is recovered in a usable state. Industrial reprocessing of waste materials is undertaken either to recover a particular component of the waste material (e.g. solvent or a chemical compound) or to blend the waste material with other components to produce a material from which products can be made.

Material Recovery

Material recovery may be distinguished from recycling by the high technology processes and equipment used to recover the majority of the waste stream (up to 90% by weight) for reuse in existing industrial operations. The majority of the waste stream in such facilities is normally recovered as a fuel fraction (refuse derived fuel - RDF) which is used as a supplementary fuel in existing facilities, such as boilers or cement kilns co-fired with fossil fuels. Processing increases the heat value of the refuse derived fuel compared to the original waste. Other materials recovered include ferrous and non-ferrous metals, glass, and plastic. An advantage of materials recovery over energy from waste systems is that it may permit marketing to several customers as opposed to one energy customer.

Energy Recovery

Energy recovery is most commonly identified with the mass burning of waste as practised in several hundred plants around the world, principally in Europe and Japan.

The forms of energy that can be generated in an energy from waste facility are hot air, hot water, low pressure steam, and high pressure steam, the latter usually in conjunction with co-generation of electrical power. Waste, normally raw but possibly pre-processed (shredded and classified), is burned in a furnace with energy recovery appropriate to the market. The furnaces may be modular (shop fabricated) units (100 tonnes per day or less each) or field-erected integral units (150 to 1000 tonnes per day each). Most units are designed to burn raw waste on some type of grate, but a number of larger units burn pre-processed waste (RDF, wood waste) in suspension with final burnout on a grate.

The location of such a plant is more dependent upon the location of the market than a materials processing plant and would be located as close as possible to the industry or institution using the energy.

Technologies such as fluid-bed and pyrolysis incineration are still in various stages of development and are currently not proven to the same level as conventional incineration units. Examples of energy recovery using modular incineration are found at Ontario's Experimental Plant for Resource Recovery, Charlottetown, P.E.I., integral grate incineration at Montreal and Quebec City, and suspension incineration at Solid Waste Reduction Unit, Hamilton.

COMPARISON OF WASTE REDUCTION, REUSE, RECYCLING AND RECOVERY TO DISPOSAL

Since there will always be a need for landfill, prudent waste management planning for future needs is essential. This is becoming increasingly important because some municipalities are running out of available land for landfill within their own boundaries. These municipalities must demonstrate that their landfill requirements have a higher priority for such land use in neighbouring municipalities than the residents of those municipalities may have planned. Agricultural land, in common with many other developments of modern society, is in many cases a candidate for landfill.

Each of the four Rs of waste management (reduction, reuse, recycling and recovery) offers advantages over disposal of waste. Each results in a reduced quantity of wastes requiring landfilling, thereby extending the life of existing landfills and minimizing the demand for future landfill space. Also, each results in the recovery of the material and energy resource values in the waste stream and in primary resource conservation.

Waste reduction could have direct economic benefits to a municipality in reducing costs for collection and disposal. A significant reduction in waste quantities would have to occur for the benefits to be of sufficient magnitude to affect collection costs. There are long term benefits, however, that can be realized only if a start is made in this direction.

Wastes entering a landfill site vary in their environmental impact. Efforts to minimize the entry of wastes that have a potential impact on the environment will have long term benefits, both in simplifying the design of the site and avoiding problems that could arise in future. Waste reduction, reuse, recycling, and recovery can help to minimize such problems.

CURRENT EFFORTS

Provincial efforts to promote the four Rs have been continuing for over a decade. In spite of these efforts, current municipal projects in the area of waste reduction, reuse, recycling and recovery have minimal impact on the total quantities of waste handled in the Province of Ontario. Existing activities are the result of personal commitment to the philosophy of recycling or to a proven benefit, usually financial. In both cases, environmental benefits are normally not of sufficient magnitude to be readily perceived. The general public, industry, and government do not have a co-ordinated goal in their approaches to recycling and recovery. The short term economics are obvious but the long term benefits frequently are given low priority. While the benefits of waste reduction may be intuitively obvious when the issue is raised, there is often little incentive to the individual to practise such activities apart from personal satisfaction. The waste-conscious individual cannot readily relate his activities to a reduction in taxes, an improvement in the environment, or a better standard of living. The same is true of the individual participating in a source separation project.

Citizen-oriented source separation has been pursued to varying degrees in approximately 75 municipalities. The specific level of activity depends on various factors, including the economic situation, municipal budgets, interest group pressure and waste management system status. Estimates indicate that approximately 50,000 tons per year have been recovered through these programs; this represents less than one percent of the provincial waste stream.

Recovery is highly dependent on public participation, which in turn is influenced by attitudes, awareness of a program, level of service and quality of service. Diversion of 5 to 20% of the municipal waste stream is attainable if reasonable levels of service are provided.

Markets

A key factor in the success of projects, whether source separation, material recovery, or energy from waste is the availability of a market for the product recovered. Industry demand thus determines the success or failure of such activities. Demand for recovered materials or energy is beyond industry's direct control, in many cases, as it is subject to changing economic conditions on a national or international scale. These external influences result in fluctuations in demand which tend to discourage initiation of municipal recycling activities. A municipality cannot plan to recycle a specific quantity of material over a given time period because it has no guarantee of a market. A municipality, however, can be aware of market conditions and be active in the market place whenever conditions are favourable to take advantage of opportunities as they develop. In cases where an institution provides an energy market, the project risk is considerably reduced because the market is more reliable and predictable.

The current state of the economy is having an adverse effect on recycling activities. Markets for recovered materials are generally in a depressed state. The Ministry of the Environment monitors the market for recovered materials in conjunction with the sales of materials from the Experimental Plant for Resource Recovery and the Source Separation Funding Program. Reports on the market for corrugated cardboard, glass, ferrous metals, waste newspaper, refuse derived fuel, compost, and fine papers are prepared on a routine basis and are available on request.

The Ministry of the Environment's Experimental Plant for Resource Recovery has been in operation since 1978. The purpose of the plant's operations is to permit evaluation of technology for resource recovery and to provide tonnage quantities of recovered materials for market development purposes.

Corrugated cardboard is manually recovered and is routinely sold to industry. Ferrous metals are magnetically removed and have been sold as scrap to the iron and steel industry. Mini-steel mills have been the principal customers for the ferrous metal and have been able to use it in loose form as recovered. A detrimental factor is the presence of even small quantities (less than 2% by weight) of paper and plastic which spoils the appearance of the finished product. A system installed at the Experimental

Plant to clean up the product has increased its acceptability in the market place. Iron foundries have also used municipal ferrous scrap but require it in a more dense form, such as bales.

Compost from the plant has been used in demonstrations ranging from land reclamation to an agricultural soil amendment to potting soil. Sales of compost have been growing steadily. Important factors in the production and marketing of compost include its visual appearance and stability. Compost is a soil conditioner. If it is insufficiently stabilized it could have an adverse effect on plant growth. Because compost is a soil conditioner rather than a fertilizer, it commands a relatively low price in the market place. The low price severely limits the distance the product can be shipped.

Refuse derived fuel (RDF) is the major product from the plant. A permanent market for such material has not yet been established. A number of demonstrations of potential uses for this material (cement kiln, brick industry) have indicated that it can be an acceptable supplementary fuel from a technical viewpoint. The decision to use such a material on a routine basis requires acceptance from many other perspectives as well as the technical one. Industry has not yet assigned a high priority to the use of RDF. Can this attitude be changed?

Source separation activities produce two main products; waste newspaper and glass. Smaller quantities of ferrous metals, corrugated cardboard, and fine papers (office and computer papers) are also recovered. The recent decline in the economy has adversely affected the waste paper markets but the glass market remains strong.

The completion of Ontario Paper Company's new de-inking plant in Thorold will create a steady demand for waste newsprint in Ontario and should help to stabilize the future market situation. This one plant, however, is unlikely to generate sufficient demand to accommodate all future source separation activities involving newsprint recovery. Should the government play a stronger role in developing other markets?

Incentives

The Resource Recovery Program announced in 1974, offered capital grants and loans to municipalities for the construction of resource recovery plants. While a number of studies were undertaken to determine the location of such plants, none were built because of the high capital costs and risks involved with both the technology and the potential markets. Municipal and industrial response to the program in the final analysis was poor; no one was willing to accept the risks even with provincial capital support. The major thrust of such plants would have been to recover materials, representing from 40 to 75% of the input waste, for use within existing industries or institutions to offset capital costs of projects. The principal product proposed was a refuse derived fuel. In 1979, the responsibility for energy from waste was transferred to the Ministry of Energy. The efforts of the Ministry of the Environment on material recovery and reuse and the Ministry of Energy on energy from waste are co-ordinated through an Interministerial Committee on Energy from Waste. Provincial funding for energy related studies, demonstration projects, and operational facilities is available.

The Ministry of the Environment provides 50% of the cost of long range waste management planning studies undertaken by municipalities. These studies consider material recovery, either through a processing facility or source separation, and energy from waste opportunities as part of the waste management plan for the municipalities involved.

If an energy from waste option is considered viable within the study area, the Ministry of Energy can provide funding on a 50-50 basis to carry out a detailed feasibility study. The energy user and the municipality would usually share the costs for a 50% portion of the total cost for the study area. This study assesses the economic and financial viability of the project through an analysis of the proposed energy market, preliminary plant design and costing, and addresses various ownership/financing options. Should a project prove financially viable, capital grants are available at the Federal and Provincial levels.

To date, viable energy from waste projects are proposed for London, Toronto, Niagara Region, Kitchener-Waterloo and North Bay.

The Ministry's Source Separation Program encourages the development of municipal scale projects where there is a demonstrated potential for economic viability in the long term. Assistance is provided for several key aspects of the projects: planning, advertising and initial start-up.

To date, assistance has been provided to eight projects for a total commitment of $330,000 in the 1982/83 fiscal year. These projects recover, overall, approximately 2% of the municipal waste generated in the areas served by the systems.

The intent of the program, as noted, is for municipal scale projects. The program does not specifically address the needs of volunteer groups. In many municipalities the efforts of such groups provide a significant contribution to the total quantity of material recycled. Volunteer groups normally do not have the capability to process, sort, and market materials or to provide the level of service for a regular community wide project. When such groups have requirements for capital equipment (bins, a building), the Source Separation Program cannot provide for these needs because it provides start-up assistance rather than capital grants. The scope of the program could be expanded, but it is considered preferable to provide assistance through the local municipality to ensure continuity of service and co-ordination of local projects. Local administration of projects is required to avoid duplication of services or competition for the collection of materials.

The assistance provided for municipal scale source separation projects has been directed to private companies operating with the consent of the municipality. The Ministry of the Environment is encouraged by the commitment and efforts of these companies, especially during these difficult economic times, but somewhat discouraged by municipal response. Since the Source Separation Program was announced in August, 1981 at the annual meeting of the Association of Municipalities of Ontario (AMO), no municipality has applied for funds for a municipal scale project. The favourable comments on the Program to the Ministry of the Environment by municipalities at the time have not been followed by action. While the depressed economy is an obvious barrier to new programs, there is concern that most municipalities have not taken a more active role in planning and co-ordinating such projects in their jurisdictions. When more favourable economic conditions return, the positive attitude expressed at the AMO

meeting is expected to be pursued through commitments to source separation projects.

BARRIERS TO RECYCLING

Two of the major barriers to greater levels of waste reduction, reuse, recycling and recovery are inertia and costs.

The public attitude is generally positive, according to most surveys, but actual participation levels in source separation projects fall short of expressed willingness to participate. This is not so much a barrier as it is a challenge which education must help to overcome. While the individual citizen often obtains no direct recognizable benefit from recycling, his involvement is crucial.

Perhaps this perceived lack of direct benefit also explains the acceptance of disposable or convenience products. While there is individual demand for products that give rise to wastes, both municipal and industrial, there is not a collective sense of responsibility for these wastes when they must be disposed. There is a general willingness to pay the price to let someone else assume the responsibility for our wastes. Having paid the price, there is a reluctance to be affected by these wastes in any manner associated with their treatment and disposal.

Industry practises waste recycling and waste reduction where it is financially attractive to do so, and frequently this is done on a large scale. In recent years, many industrial processes have been modified to avoid environmental problems from plant discharges. In solving many of these environmental problems, industries discovered that they could also save money and make their processes more efficient. Some of these experiences were recently documented in the Pollution Probe book "Profit from Pollution Prevention". Improvements can be achieved by considering both environmental and financial factors. A longer term approach is suggested; long term financial payback with positive environmental aspects is preferred to a better short term payback with negative environmental impact. There is a need for industry to be as environmentally aware as it is now financially aware.

Industry provides the markets for recovered or recycled materials, both from municipal and industrial projects. Institutions could provide a stable market for energy recovered from waste. In establishing cost effective operations, many industries have become vertically integrated from the virgin raw material to the finished product. This integration does not readily allow for the introduction of external sources of supply, especially waste materials, which may affect the plans or profitability of one element of the overall operation. It becomes difficult to establish the value of recycled materials when there is no history of prices from external sources of supply.

Those industries now dealing in secondary materials have established a framework and understanding within which they conduct their business. Unfortunately, the recycling of waste from municipal sources has been given low priority, as demonstrated by the current level of activity. There is also a reluctance to have other parties enter into the same market place in which they have been dealing for years or to have established market sources displaced. The short term economic benefits have been assigned a much higher priority than long term environmental benefits.

Municipalities have provided services for their citizens, including waste collection and disposal, water supply, waste water treatment, and maintenance of streets and parks. These services, provided routinely and based on historical precedents, can be well planned. The planning of waste management facilities appears to have been given a lower priority. The recycling of materials, which face uncertain markets both in terms of quantities and price, complicates long term planning. Most municipalities do not seem prepared to deal with such situations as is evidenced by their willingness to allow a private company to operate on their behalf in this area. While this has some logic in view of the recent evolvement of recycling as a waste management option, the position of most municipalities with respect to recycling needs to be well defined. The Ministry of the Environment has been supporting efforts to develop and establish markets for materials recovered from municipal solid waste. While the potential for many initiatives has been identified, most have not been undertaken. The Ministry of the Environment is seeking ideas that would assist in establishing new markets and improving the stability of existing markets.

There is a general expectation that because a recycled material is sold, a profit will result. This is not necessarily true. There appears to be a municipal reluctance to support an activity which involves the sale of material yet still costs money. These circumstances are not unusual as many other municipal services require considerable financial support. While it is reasonable to attempt to minimize costs by receiving the maximum revenue, the net costs must be viewed in terms of the options available and the total benefits, not only financial, that will result. In many cases, the real costs of present waste management methods are not sufficiently established to permit a meaningful comparison.

Establishment of energy from waste plants and material processing plants presents a challenge to most municipalities. The capital costs of such plants exceed what municipalities are accustomed to spending on waste disposal facilities or on many other municipal capital projects. The high technology of these operations no doubt also leads to reluctance to proceed with undertakings at the municipal level. Both waste processing and energy from waste plants approximate an industrial operation. This is especially true for an energy from waste facility, which would normally operate 24 hours a day, 7 days a week, not only to dispose of a municipality's waste, but also to satisfy the energy customer's demands.

The waste management industry became financially involved in innovative waste recovery projects during the mid-1970s. Recently, however, this industry has invested less in such projects.

COSTS OF WASTE MANAGEMENT OPTIONS

Collection and Disposal

Landfill disposal costs are expected to increase in the future as the level of technical operation of sites improves to reduce risks of future problems from gas and leachate migration. Collection costs for municipal solid waste in the majority of cases are not well documented and are not comparable from one municipality to another. This is because of different levels of service offered (e.g. once a week versus twice a week pickup), type of equipment used, crew size, and cost accounting practices. A similar situation exists for disposal costs. The costs of municipal waste collection, based on available information, are normally in the $20 to $50 per tonne range.

Landfill disposal costs for municipal solid waste are typically in the $5 to $10 per tonne range, including capital costs. Development and operating costs of new sites will increase as the general public becomes more aware of waste disposal practices and demands better operations. These demands will be based on past problems or problems in other jurisdictions. Many of these problems were due to poor operations either through a lack of knowledge, inconsistent enforcement of regulations, neglect, or ignorance of the future consequences. Handling future problems should be a part of disposal costs; this is reviewed in detail in Appendix 3 to the Blueprint, Perpetual Care Program Report. The costs of waste management will increase in response to demand for better waste management systems.

Energy from Waste

Energy from waste (EFW) projects are capital intensive. Total costs are in the order of $50,000 to $65,000 per tonne of daily capacity. This initial financial burden must be offset by revenues generated by the sale of the energy produced and by tipping fees.

Operating costs are higher than for landfills because sophisticated equipment must be maintained at high industrial standards. This is essential to provide a consistent energy supply to the energy consumer and to earn the revenues to pay for the facility and its operation. Gross operating costs of $30 to $40 per tonne can be expected. With tipping fees and energy revenues to cover the operating and capital costs, these projects are expected to pay their way over their lifetime. Unfortunately, no such facilities are operating in Ontario with which to test the validity of such expectations or to serve as a model for others to follow. A few projects are, however, now in the planning/approval stage.

An EFW project, because of the capital financing burden, may have costs in excess of those of a current landfill operation for the first few years of operation. The impact of this burden can be partially offset in a number of ways, such as federal grants, provincial grants, innovative financing arrangements, and by the energy customer paying energy costs equal to fossil fuel generation costs in the initial years of operation, with substantial energy cost reductions when cash flows permit.

When the economics of an EFW project are compared with the true costs of landfilling, the benefits of an EFW approach are more readily shown. The current costs published for landfilling typically do not include interest charges for land and equipment costs, engineering and approval costs, reserve funds for future equipment, site development and closure or perpetual care costs.

The costs of all types of projects, landfill or processing, must be assessed on a long term or life cycle basis. This is readily shown in comparing landfill disposal with EFW options. In the short term, the capital burden of an EFW project is higher than the relatively low capital costs of landfill. In the long term analysis, however, EFW projects with their revenues may compare favourably with the costs of landfill.

Source Separation

Ministry experience with actual source separation projects to date indicates that the costs of recycling are not offset by the revenue received for the materials recovered. This experience is for the recent period of an economic downturn and depressed markets. While it is expected that, in a more favourable economic climate, this situation will improve, it may not reach a break-even or profit position. The costs are also higher than regular collection and landfill disposal, although the gap is likely to be narrower in municipalities with high disposal costs. Economics are highly site-specific but the following example indicates a typical situation for a small municipality:

	Regular	Source Separation (Newspaper, Glass, Cans)
Collection	$12.00/tonne	$78/tonne
Disposal Fee	$13.50/tonne	---
Revenue	---	$32/tonne
Net Cost	$25.50/tonne	$46/tonne

When the avoided disposal fee is applied as a credit to the source separation program, the net cost ($32.50 per tonne) is still higher than regular collection and disposal. It is likely that the true cost of disposal exceeds $13.50. It is unlikely, however, that it will change the significance of the higher net cost of source separation.

This simple analysis raises the question of whether society should be willing to pay for the social benefits derived from the recycling of waste where a market does exist. If so, how much, who pays, and how? Comments are invited.

Material Recovery

The costs of material recovery in a processing plant depends upon the range of materials recovered which would likely include refuse derived fuel, ferrous metals, and corrugated cardboard. Capital costs would be approximately $25,000 per tonne of daily capacity. Gross operating costs of $20 to $30 per tonne could be expected. The net costs would depend upon the markets for the products and tipping fees. With tipping fees comparable to those charged at a landfill, it is unlikely that such a plant would break-even.

Composting

Composting of both sewage sludge and municipal solid waste has been gaining in popularity recently. A composting plant for municipal solid waste would require a material preparation system similar to a materials recovery plant, and a system to screen the final product. With process losses at both ends as well as through decomposition, the compost product would represent approximately 35% to 50% of the input waste. Residues would require landfilling. Capital and gross operating costs would be similar to those for the material recovery system. Revenues would be low and product demand is seasonal with peak demands in the spring and fall. Storage of the product for curing and during the off-seasons would also be required. The production of compost to satisfy a municipality's own demand for soil amendments should be considered.

It is interesting to note that major municipal composting operations (mainly in the U.S. and Europe) are employing mechanical composting systems. The Experimental Plant for Resource Recovery uses a mechanical composting system to compost a fraction of waste recovered by air separation. The screened product has been used following a curing period for a number of uses including land reclamation, turf growing, and as an agricultural soil amendment.

Composting is one way the individual can participate in waste reduction. The costs to the homeowner are minimal and the direct benefit, compost, is obvious. The safety of the home compost product would be of little concern because the homeowner knows precisely the source of his own product. The indirect benefits of home composting are more difficult to quantify but include waste reduction and an increased awareness of waste.

Future Costs of Waste Management

Costs of waste management in the future will depend upon the direction we choose to take.

It is highly unlikely that there will be a major breakthrough in solid waste management technology or waste generation rates in the near future that will significantly affect the plans made now. Waste management costs will likely increase to satisfy public demands for more stringent regulations, better engineered and operated facilities, and more input into the decision making process.

Past decisions have been made on the basis of direct costs without full consideration of the indirect costs and benefits. It appears that society is becoming more aware of these aspects and wishes to have them considered in the decision making process. It is imperative that the public, municipalities, industries and governments at all levels reach a common understanding of the problems and the possible solutions in order to select waste management systems that are environmentally sound and cost effective. There is at times a misunderstanding of the capabilities and limitations of various components of waste management systems. For example, no waste processing or recovery system (material recovery, energy from waste, source separation) will eliminate the need for landfill. All parties involved in the decision making process for waste management systems have a responsibility to be aware of these capabilities and limitations. Otherwise, the decision making process will be unnecessarily prolonged and the final result will likely be less desirable than could have been achieved through a co-operative approach.

WASTE MANAGEMENT ROLES

Municipal Role

The municipal role in waste management has evolved to the provision of a routine service to the general public for collection and disposal of waste.

In most municipalities in Ontario, this service is limited to residential and some commercial collections. Industrial waste collection is normally left to the private sector. Waste disposal from both municipal and industrial collections is normally at municipally operated sites. The quantity of waste collected and disposed is unknown in many municipalities because of a lack of records or weighscales to generate such data. This type of data is becoming increasingly important, especially for planning and designing capital intensive projects such as energy from waste or material recovery plants. There are a number of examples in the U.S. where, lacking such data plant designs were based on over-estimated waste generation rates. The economic impact on the completed facility is severe when the expected revenues from tipping fees and product sales do not materialize. The costs involved in equipment and manpower to generate such data are a minor component of waste management costs. Without such data, it is impossible to know the true cost of waste management and to be able to effectively plan for future waste management systems. Smaller municipalities, in particular, are encouraged to do a better job in developing their data base.

Participation of municipalities in waste recycling has been inconsistent. A number of municipalities have been actively involved in curbside collections, operation of depots, and marketing of recovered materials. Curbside collections and depot operations are within the scope of municipal operations. Municipalities are best qualified through their experience in dealing directly with the general public to be able to establish the means of providing the required service. Municipally oriented organizations such as the Association of Municipalities of Ontario, the Governmental Refuse Collection and Disposal Association, and the Municipal Engineers Association are examples of available means of exchanging information or of defining needs or problems which cannot be dealt with solely at the municipal level of government and require support from the Provincial or Federal levels. To date, the Province has had very little input from such organizations to

indicate the future direction of waste reduction and recycling in particular, or waste management in general, or the role that the Province might play in fulfilling outstanding needs.

With support by Environment Canada and assistance from the Ministry of the Environment, the Regional Municipality of Waterloo has undertaken a demonstration Industrial Waste Management Program to assist industry in making decisions on how to better manage their process wastes. Through this program, the Region has created an Information Centre for technical and other assistance and will facilitate opportunities for local industries to buy and sell waste materials, offer technical information through seminars on waste handling and storage, and provide case histories from other industries of successful waste reduction, reuse and recycling. Such programs could set the tone for improved waste management through greater municipal involvement in the future.

Provincial Role

A major provincial role in waste management has been to formulate regulations, policies, and guidelines for the protection of public health and the environment. The need for such a role was obvious when the Province formally became involved in waste management in 1970. The regulations and guidelines instituted since 1970 have been instrumental in major improvements in waste management in the Province. The Blueprint recognizes that there is considerable room for improvement and expansion of programs of less conventional means of waste management, such as recycling through waste processing, source separation, and energy from waste plants.

The Ministry of the Environment's Resource Recovery Program announced in 1974 did not result in the degree of change in waste management practices that was anticipated at the time. Municipalities participated in studies to plan for such changes but did not avail themselves of the capital grants offered. Admittedly, the financial risks were high and the technology was only in the development stages. The remaining question is how to proceed to spur developments in the area of waste recovery. There is often a greater financial risk with innovative capital intensive plants but such risks should be assumed if progress is to be achieved.

The Experimental Plant for Resource Recovery has provided first hand knowledge about the technology and market development aspects of waste processing and materials recovery. We have learned of some of the capabilities and limitations of processes and the changes that must be made to accommodate the requirements of industrial customers. Industry has learned how to use materials recovered from municipal solid waste. Demonstration projects using the plant products have been carried out and are continuing. The plant has also served to educate the many visitors who have toured the facility. At this stage in the Provincial efforts in investigating and pursuing waste processing, there is a question of what our future direction should be and how we can best address the needs of the general public, municipalities and industry.

In 1981, the Ministry of the Environment announced a program of financial and other types of assistance for source separation activities in the Province. The Ministry has provided grants to eight private companies involved in source separation. Six of these companies are involved in municipal scale projects and two in office paper recovery projects. Funding through this program is limited to a three year start-up period. Current projects will begin to reach this three year period late in 1984. The future of these and other projects likely to start when economic conditions improve is now uncertain. Should the Ministry of the Environment modify its program to provide some means of continuing support if required? What complementary programs will municipalities implement to further such projects? What are the criteria which should be used to evaluate the success of such projects -- financial, percentage waste diversion, or others? What other programs are necessary to provide for waste reduction and recycling beyond the 5% to 20% waste diversion from landfill expected from source separation projects?

The Provincial government has introduced programs to establish new approaches to waste management. Response by municipalities and industry to these programs to date has been disappointing. Some perceive that through such programs, the Province will play a more active role in day-to-day waste management activities. Such a role is inappropriate for the Provincial government which can better serve the improvement of waste management practices through a lead role in the assessment of technologies.

Some suggestions on the type of programs that may improve the current situation are presented in a following section, "Future Directions". Comments or recommendations on these or other possible approaches are sought to help in identifying and establishing more effective waste management systems.

Industrial Role

The industrial role in waste management has been varied. Industries range from those specializing in waste recycling to those producing wastes for which no adequate treatment or disposal facilities exist in the Province. The number of industries in the latter category and the severity of the problem was sufficient to cause the Government of Ontario to respond by creating the Ontario Waste Management Corporation to assist the generators and private industry in disposing of such wastes.

The companies specializing in waste recycling normally deal with specific materials or types of material, such as scrap metals or waste papers. Their recycling activities are primarily concentrated on industrial wastes rather than municipal wastes and many of them have been reluctant to become openly involved in materials derived from municipal solid waste.

Primary industry, which provides the market for recycled materials has often not taken a positive attitude towards reusable or recyclable materials derived from municipal solid waste.

The major basic steel producers have expressed some interest in municipal ferrous scrap but have not actively promoted the use of this particular grade of scrap. Mini-steel mills and foundries have tried municipal ferrous scrap for their operations, and have, in the majority of cases, been satisfied with the results. The major steel industry has shown interest but has done little to further municipal ferrous scrap recycling. As one of the major material recyclers, in terms of tonnage and the percentage of scrap used in their processes, the steel industry could take an active role in offering a firm market for municipal ferrous scrap. This would represent a minor part of their scrap demand yet provide a major benefit to municipalities considering recycling activities. The Ministry of the Environment is prepared to co-operate with the steel industry to achieve this goal. Concerns regarding 'inhibiting elements' in municipal ferrous

scrap could be handled by a judicious use of this type of scrap. Over a period of time, the quality of such scrap could be determined so that any limitations to its use could be identified.

The paper industry is also a major user of recycled material. In spite of the fact that 50% of the waste stream is paper, this industry as a whole uses a low percentage of recycled material in its products. Although a number of mills use a high percentage of recycled material in their products, in 1982, paper products shipped from Canadian mills contained approximately 8% recycled fibre. Ontario Paper Company has taken a lead in expanding newspaper recycling opportunities in Canada with its new de-inking plant at Thorold. While such plants are new to Canada, the technology involved is certainly not new. A fundamental question for the pulp and paper industry is whether decisions to use more recycled materials should wait until we run out of virgin materials. The answer obviously should be no. The actions of Ontario Paper Company are a positive step for recycling in Ontario. Similar actions by other mills are encouraged. Waste newspaper can even be used in small amounts without de-inking. Such efforts should be pursued to a greater extent in future.

Industry associations could assist in promoting recycling activities to a greater extent than in the past. Standards for products containing recycled materials should come from such associations. The American Society for Testing and Materials (ASTM) has a committee to set such standards for materials recovered from municipal wastes, but representation to this group from Ontario industry appears to be lacking. The Ministry of the Environment has been an active participant in ASTM activities. Progress in recycling in other countries indicates that there is considerable room to expand industrial activities in Ontario. Such efforts will have positive benefits to both industry and the people of Ontario by preserving and creating jobs, conserving resources, reducing wastes requiring disposal and keeping Ontario's industry competitive in world markets.

The consumer products packaging industry has a key role to play in waste management, both by minimizing the extent of packaging, and by ensuring that packaging materials are recyclable.

Industries are encouraged to identify products containing recycled materials. Many organizations or industries directly involved with recycling

now use recycling logos and more are encouraged to do so. The use of standard logos, a good packaging seal, or recommended recycling activity could be included on packaging to assist the consumer. The co-operation of the packaging industry to inform the consumer of packaging that can be recycled is a goal which the Ministry of the Environment intends to pursue. An appropriate government role must be defined. The packaging industry can help identify what that role should be.

FUTURE DIRECTIONS

Source separation must be viewed as an important waste management component and combined with other components available to municipalities. This should only be done after a rational plan is prepared which recognizes the potential benefits as well as the costs.

Experience in Ontario has shown that increased levels of recycling are possible once decisions are made to include recycling in municipal programs. The City of Toronto has steadily increased the amount of material recovered through its depot system since 1977. So have other cities including Georgetown, Ottawa and Burlington.

The key to developing the recycling component to its ultimate potential, is the demand for recovered materials. Even the best operated projects fail in their recycling objectives if markets are not able to absorb the supply available at economically viable price levels.

Markets, in general, for recycled materials must improve if the inherent benefits of recycling are to be achieved. All levels of government, as well as industry, can buy more products containing recycled materials. Financial grants, subsidies and tax concessions could also be considered.

One possible approach, currently being tried by certain U.S. jurisdictions, is to finance recycling activity through surcharges on disposal. This has the advantages that disposal is discouraged, recycling is encouraged, and the necessary financial support is available.

Regulatory changes in Ontario, presently under review, could include provisions for allowing the introduction of new materials for beverage containers subject to their recyclability (aluminum, plastic). This would

improve the financial viability of source separation and multi-material collection projects and thereby increase recovery levels.

Legislation requiring mandatory separation of certain materials has been passed in some U.S. cities. This approach tends to increase recovery rates even though enforcement is impractical and usually non-existent.

All recycling projects based on public involvement in sorting materials would benefit if identification of recyclable items was made easier. This would be especially significant in projects for recovery of different grades of paper or plastic. A method of distinguishing materials would be necessary if this concept were adopted by manufacturers. The Ministry could explore with industry the standardization of package markings to achieve this goal.

The Government of Ontario could encourage the establishment of major waste handling facilities, some of which might incorporate or supply energy from waste plants. In the absence of industrial or institutional energy customers for steam, generation of electricity could be pursued.

Assistance for energy from waste projects covering a portion of the capital costs relating to waste handling may be desirable. For example, assistance for post-processing of the ash (ferrous recovery) or other recovery operations (corrugated cardboard recovery).

The Ministry of the Environment recognizes that landfill disposal will be a part of every waste management system. Efforts will continue to improve the technological aspects of landfilling to minimize environmental risks and to pursue opportunities such as methane gas recovery from landfills.

Progress and achievements in waste reduction, reuse, recycling, and recovery are small when viewed in terms of the tonnage handled versus the total waste quantities produced. Developments to shift a significant tonnage from landfill will take time. The present low level of activity is of sufficient concern that some means of stimulating developments appears to be necessary. Both industry and municipal governments can play a larger role than in the past. The Government of Ontario is committed to the concept of waste reduction, reuse, recycling and recovery and is seeking

ideas on how to develop co-operative action oriented programs that would show results.

Assessment criteria to evaluate the potential and effectiveness of these ideas and programs will also be needed, and suggestions on such criteria are required. Should criteria be based on environmental benefits, social benefits, job creation, total costs, tonnage, costs per tonne, displaced raw material costs or other factors? Comments are invited.

Waste management is perceived differently by a wide range of groups or individuals through their direct or indirect involvement. A common understanding of the issues, problems, potential solutions, economics, and benefits of various waste management system components is essential if meaningful discussion and workable solutions for waste management are to take place. Past experience has shown the need for better education of all parties involved. A number of approaches to improve the level of education on waste management are proposed to reach the diverse range of interests.

Education System

Improvements in our present methods of handling waste are overdue. The education system provides a means of informing a new generation about the direction society can take and how the individual can play a role in effecting change. Educational materials, school or class projects, environmental courses with emphasis on management, would reach not only the students but their families.

Government

Government could expand its activities in waste management and through both direct and indirect involvement serve to improve the level of understanding of waste management.

Direct involvement could include the increased use of recycled materials or products containing recycled materials, such as paper, building materials, and construction materials. The use of recycled paper should be identified on stationery, reports, and publications. Purchasing policies could be changed to favour products containing recycled materials, especially from Ontario sources. The use of rubber from recycled tires in asphalt is an

example of the potential for expanding recycling activities for construction materials. Such actions demonstrate that improvements to the current situation can be made while increasing the market demand for secondary materials.

Opportunities exist within government to demonstrate to the general public and industry the potential for recycling. The success of the Provincial Government's office paper recycling program has already been demonstrated. This success has led to similar programs being started by other levels of government and in private industry. Further potential for such programs exists if greater utilization is encouraged or required where they are in place. Other opportunities for material recycling exist, but remain to be pursued, demonstrated, and the results presented to all levels of government, the public, and the private sector for broad scale implementation.

Governments and industry frequently purchase products which are not recyclable. The use of such products should be identified and minimized where an acceptable alternative containing recyclable material is available.

Many government agencies are involved in establishing standards for products for use either by the government or others. Such standards should give full consideration to the use of recycled materials. All government staff involved in such activities should be encouraged to promote a greater emphasis on waste reduction and recycling. The Ministry of the Environment could provide a co-ordinating role to resolve problems, undertake research, and publish reports on results.

Incentives to Promote the Four Rs

Current activities in the four Rs related to municipal wastes may require additional incentives to encourage more action, to change attitudes, and to demonstrate the long term benefits. It is proposed for discussion that a fee be levied at all disposal sites as a means of providing funding for such increased activity. The fee could be based on waste quantities and could be collected by the same agency as proposed for the Waste Management Security Fund (see Blueprint Appendix 3). A fee of approximately $1.00 per tonne is initially proposed for discussion. Such fees have been used in other jurisdictions recently and have been successful in increasing recovery

and recycling activities, but there is insufficient experience with such programs to determine their long term impact. The Ministry of the Environment will follow the progress of such programs in Nebraska, Colorado, Washington, Ohio, California, and New Jersey to establish the best method of collecting and administering the funds and monitoring the effects.

The funds could support a broad range of needs in the four Rs. These include capital and operating costs, grants, rebates, research, education and promotion.

Capital cost support could be provided for material and energy recovery facilities, source separation facilities, and expansion of industrial operations to increase the demand for recycled materials.

Operating cost support could be similar to that now provided under the Source Separation Program, in which the need for support during the start-up years of projects is recognized.

Industry would be encouraged to expand current activities and to increase demand for recycled materials. Support is intended to establish Ontario industry as a leader in this area.

As an added incentive, the fund could provide grants for recycled material usage based on quantities recycled. Recognizing the need for municipal involvement in such activities, it is suggested that such grants be provided through municipalities for activities within their jurisdictions. This approach has been taken by the State of New Jersey.

In many cases, a means of supplying small-scale equipment is needed to implement projects. The fund would readily provide for such needs. Examples include desk-top holders and bins for office paper collection projects, compartmentalized containers for participants in municipal source separation projects, and home composting units for homeowners.

Research or demonstration projects could be funded in all areas of waste management. Criteria for evaluating proposals would have to be developed but it is recommended that preference be given to proposals with

significant environmental impact, major influence on the waste stream, and potential for quick implementation.

The educational and promotional activities outlined previously would also be supported by the fund.

SUMMARY

Accomplishments in waste reduction, reuse, recycling and recovery have been growing gradually over the past ten years and there is increasing pressure from the general public to expand these accomplishments and lessen the demand for landfills. Further progress will require co-ordinated efforts by the general public, industry, and government at all levels. Comparison of our achievements with those of other countries indicates that we can do more. Methods used in other countries could be adopted or new ones established.

Industry provides a key element in most recycling activities - markets. Many industries are already based on using a significant percentage of recycled material in their processes. These industries are encouraged to expand their activities to include materials recovered from municipal as well as commercial/industrial wastes. Other industries are encouraged to follow suit and to attempt to reduce the quantity of wastes produced. Greater use of waste exchanges, such as the Canadian Waste Materials Exchange, which is managed by the Ontario Research Foundation, is also encouraged. Industry's suggestions on ways to improve existing programs for the promotion of waste reduction, reuse, recycling, and recovery and on new ideas that can be developed are sought. We invite ideas from industry on how it can provide additional recycling capacity and how government assistance can be co-ordinated with industry's efforts to achieve this goal. Industry must look beyond financial returns when considering recycling. With appropriate incentives, recycling activities can become a part of many more industries' routine operations.

Municipalities should take a more active role in future both by providing increased levels of service to promote recycling and by increased discussion with industry and other levels of government to co-ordinate recycling efforts, to offer suggestions for improvements of existing programs, and to better plan their waste management systems.

The Ministry of the Environment has been involved for the past ten years in efforts to improve waste management practices through various programs, regulations, policies and guidelines. Programs to promote waste reduction, reuse, recycling and recovery have produced positive results but, in general, their impact is less than was originally envisioned. Provincial efforts to promote the benefits of such programs will continue. During this major review of the entire waste management area, input from the general public, municipalities, and industry is required to develop programs and policies that will produce waste management systems of the future that will protect the environment and serve the people of Ontario.

Schedule of Appendices

1. Waste Management Consultation Session Report
2. Waste Reduction, Reuse, Recycling and Recovery Report
3. Perpetual Care Program Report
4. Interim Guideline for the Interpretation of the Hazardous Waste Definition (Regulation 309)
5. Legislative Implications of the Blueprint for Waste Management
6. Proposed Revisions to Regulation 309
7. Proposed Revisions to Regulation 313
8. Proposed Generator Regulation
9. Terms of Reference for a Waste Management Master Plan
10. Solid Waste Management Cost Accounting Summary Report
11. Proposed Regulation Under the Environmental Assessment Act Regarding Private Waste Disposal Sites